several reasons it has not been in the power of some foreign Governments to be represented at the Exhibition. And in more than one case, notably that of Chili, an unforeseen accident occurred to prevent others who intended to be present. Where direct participation, in so far as exhibits are concerned, has been impossible, official maps and publications bearing on the forest service or literature of the country have been forwarded, or a representative has been commissioned officially to attend, or the efforts of private individuals have been exerted to supply the omission. The Exhibition has thus been inaugurated by the co-operation of many of the foreign and colonial Governments, and by the good wishes of all.

In the arrangement of the articles exhibited the geographical principle has been adopted, the goods of each country being together.

A scientific arrangement was very desirable, and the "classification" issued by the Executive Committee was prepared with that intention, but it was found impossible to arrange the Catalogue in accordance with it, from the imperfect details given in many of the schedules of exhibitors, and the tardy arrival of the consignments. Great latitude has been allowed to the admission of goods, which have been largely received during the week since the opening, and we believe that the very large and interesting collection from Japan will be in its place in a few days.

The Catalogue contains much valuable information, especially the portion relating to India and the Scottish Arboricultural Society, which together cover eighty pages; but it is not yet complete with respect to several colonies and foreign Governments, notably Japan. A new edition is promised, more easy of reference, where the theoretical classification of the articles on paper will agree with the actual distribution in the building.

The ground on which the buildings are erected is 5 acres in extent. The main building is 650 feet long by 55 feet broad, with three annexes, each 150 feet long by 55 feet broad, with a high central dome in each annexe.

The design of the buildings is similar to the main galleries in the Health Exhibition, Kensington. Additional annexes, 500 feet long and 25 feet broad, similar in design to the main buildings, were erected at a later stage in consequence of the large demands for space by the Japanese Government, &c.; the exhibiting area thus became one-third larger than its original extent. It is a handsome light building which produces a very agreeable effect on entrance.

The Electric Railway runs along two sides of the building, and is about 650 yards in length. On the west side of Donaldson's Hospital grounds a field 7 acres in extent was inclosed for the purpose of exhibiting woodworking machinery in motion, nurserymen's exhibits, greenhouses, iron houses, wire fencing, gates, &c. Here will be found various huts and châlets, including one from Balmoral; also the Manitoba Settler's Farm, and many varieties of models of gates, fencing materials, &c., exhibited by the Commissioner of Her Majesty's Woods and Forests, all having a connection with the wide subject of forestry.

The Indian collection occupies the south central transept, and several bays on each side; it is very large and interesting; the catalogue has a historical preface by Sir George Birdwood. The arrangement is admirable, Col Michael and his assistant having had experience in the Paris, Vienna, and Amsterdam Exhibitions.

The Index Collection of Timbers sent by the Government of India, comprises 800 specimens, with their commercial uses and habitats, and illustrates arboreal vegetation from Thibet to Cape Comorin; each specimen is carefully labelled.

In the Indian Court may be specially noticed the very valuable series of maps and diagrams executed by the Forest Survey Department under Major Bailey, R.E., who has himself arranged them in an instructive manner. The excellence of these topographical surveys can scarcely be overrated in connection with the demarcation and management of the reserved forests divided into blocks or compartments, and in the case of boundary disputes their value is undeniable. For students of forestry this is a most important feature of the Exhibition, and shows the silent progress of the great work which has been carried on by Dr. Brandon and his assistants during the past twenty-five years.

The only other country which exhibits maps showing in detail the general distribution of forests is Denmark. There are three sheets displaying the occurrence of the forests of conifers and of broad-leaved trees, also the extent of newly-planted areas and the geological formations on which they grow. There are also maps of the forest district of Kronborg which resemble those made in Germany, and are very neatly executed.

It would have been very desirable that sets of these illustrative maps had been furnished as far as possible by various Governments to assist in determining the rates of growth of indigenous trees in different countries. For instance these diagrams give the mean height from 20 to 120 years, and show that in Germany the height of beech and spruce is greater than in Denmark; but the average diameter of the latter exceeds that of the former.

In the Indian collection an interesting contribution from Col. Yule has found a temporary resting place. Marco Polo, who tells us of the existence of the roc, a bird of wonderful dimensions, further tells how the feather or quill of the roc was brought back by envoys to Madagascar or East Africa, and presented to the Great Khan. Col. Yule and Sir John Kirk seem now to have brought to light the true roc's quill in the frond of the leaf of the *Raphia* palm, which is largely used on the coast near Zanzibar for making stages, ladders, rafters, and doors. The hard ligneous frond, stripped of its leaflets, somewhat resembles a stripped feather; the largest is twenty-five feet four inches long, and twelve inches in girth at the base.

TECHNICAL SCHOOL EDUCATION AT THE HEALTH EXHIBITION[1]

IN last week's issue some account was given of the appliances, methods, and results of primary school education to be seen at the Health Exhibition, and we ventured to express the hope that this remarkable and probably unprecedented collection would be carefully inspected by as many as possible of our schoolmasters and mistresses, as well as by school managers and others. In the present article it is proposed to deal similarly with technical handicrafts and science teaching as practised not merely in England, but in those foreign countries and organisations which, as previously stated, have brought together such excellent collective exhibits.

The increased attention now being devoted to the whole subject of infant training, and the enlarged sympathy and interest with which the best modern teachers are studying the methods of Fröbel (some of the developments of which are at the basis of all so-called technical training), have justified the appropriation of a considerable space to illustrations of the Kindergarten system. The British and Foreign School Society have devoted the whole of the room at their disposal to this purpose, in order to make the display as complete as possible, and here will be found a practical answer to those who allege that "Kindergarten work is all play," for the manner in which it leads up to various trades is distinctly shown. In the Belgian Court there is also a very complete and effective Kindergarten exhibit, though it contains nothing specially new, and the same remark applies to that of the city of Antwerp. In the gallery of the Albert Hall (No. 1374) is an admirable exhibit, in which all Fröbel's occupations are grouped round a given object in nature, illustrating the Pestalozzian system of Kindergarten teaching, as carried out in Berlin.

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[1] Continued from p. 220

The subject of domestic economy, and other forms of technical and industrial occupation for girls, is illustrated in a very thorough manner by the Minister of Public Instruction in Belgium, and to a less extent by the corresponding official in France. A notice appended to the Belgian Illustrative Museum states that mere oral lessons have been found to produce no good results, and hence that this subject is taught in a "decided, intuitive, and demonstrative" manner, which has necessitated the formation of illustrative collections in each school. These will be found to be most complete, every stage in the manufacture of clothing and food, from the raw material to the finished product, being illustrated, as well as the more important points in house sanitation. No similar exhibit is to be found in the English section. The embroidery and other work of the "École professionelle de jeunes filles" will repay careful inspection. With regard to needlework generally, we are informed that some lady experts in this matter have a very high opinion of what is shown in the Belgian and French Courts, as well as of that sent by the Birmingham School Board, which appears to be the best English needlework. In this connection also a word may be said in support of the efforts now being made by the Scientific Dress-cutting Association, who show interesting demonstrations of their methods.

Turning now to the more general question of scientific and technical instruction as illustrated at the Health Exhibition, it will be remembered that one of the results of a comparison of English and foreign primary school methods was stated to be, that elementary scientific instruction formed a much more prominent feature in French and Belgian primary schools than in English. We notice with great pleasure that, in opening a higher-grade school at Manchester on Monday last, Mr. Mundella pointed out that one objection to English education was its too exclusively literary character. The practice of the Liverpool and Birmingham School Boards, and to a less extent of the London School Board (which in its exhibit endeavours to illustrate its whole system, and not merely certain features of it, as is done by the Birmingham authorities), is however a pleasing exception to this general statement. It cannot be denied, however, that a very much better foundation is laid in primary schools abroad than at home for that technical education the importance of which is now becoming so generally recognised, as evidenced by the extraordinary demand for copies of the recently published Report of the Royal Commission on the subject, and by the noble building in which the chief educational exhibits are temporarily housed.

It may be convenient, as in the former case, to notice first the foreign appliances for, and results of, technical education, the collection of which in point of interest and size is not so large, when compared with the corresponding English exhibits, as is the case with the primary schools. In the Belgian Court the collections of the Ministry of Public Instruction and of the Carlsbourg School are specially noticeable; the technological collections to illustrate the various industries are most complete, and are arranged under such heads as vegetable fibre, minerals, the animal kingdom, &c., while under the head of botany is an admirable series of specimens illustrative not merely of agriculture but of arboriculture, the various methods of grafting, for example, being clearly shown. There is also an interesting collective exhibit "des écoles industrielles et professionelles," and there are no less than three societies whose sole object is the technical and professional training of women in various trades, such as artificial flower-making, dress-making, embroidery, &c. This appears to be a new departure, which might be advantageously followed in our own country.

In reviewing the recent progress of educational legislation in France, we find that in March 1882 laws were passed which rendered obligatory (1) the teaching of the elementary physical sciences in primary schools, and (2) the performance therein of a certain amount of manual work. Accordingly, under the first of these heads we find exhibited by the Minister of Public Instruction the authorised collections of objects and apparatus used in this teaching, as well as models of simple and cheap instruments such as could be fabricated by the pupils themselves. The second law alluded to has called into existence the "École normale de travail manuel," a school probably unique of its kind, whose whole course of instruction is well illustrated by a series of photographs and specimens, and by a detailed programme. It comprises the systematic teaching of carpentry, the use of the lathe, the chemical and physical laboratory, the smith's forge, and the "fitting" shop. The whole instruction is gratuitous, and admission is obtained after a competitive examination in the lower grade schools. Fuller details about this school, as well as about the present system of education in France as a whole, will be found in the ten pages of the special educational catalogue devoted to an introduction to the French exhibits. Closely associated with this is a capital collection of work from the École des Arts et Métiers of Aix (Bouches-du-Rhone), which, together with the results of various apprenticeship and art schools, is exhibited by the Ministry of Commerce, Paris. The handicraft work of the primary schools of Vierzon and of Voiron (Isère), as well as of the technical schools at Evreux and Nantes, deserves careful examination, while in the department of agricultural industry, the work of a school at Lille is much to be commended and worthy of imitation. Among the private exhibits in the French section the most noticeable features are:—the admirable collection of objects of natural history and of science diagrams, all for school use, shown by M. Émile Deyrolle, and the wonderful collection of botanical and physiological models shown by Mme. Veuve Auzoux and M. Montaudon. Part of this is a series of anatomical models (probably the best of their kind) composed of solid pieces, which can be easily adjusted or separated, and removed piece by piece as in actual dissection. Somewhat similar models are shown by Mme. Lemercier. It is greatly to be regretted that the very high price of these excellent models is an effectual bar to anything beyond a very limited use of them.

The collection of educational appliances as used in Norway, and shown by Mr. Mallings in the gallery of the Albert Hall, deserves warm commendation. It is characterised by the same importance as attached to objective and practical teaching (as distinguished from book-information) which we noticed in the French and Belgian schools. This publishing house is one of the sights of Christiania.

Prominent among the illustrations of technical education in England, the preparations for which, as we have before stated, have not yet reached down to our primary schools to any appreciable extent, are the three rooms devoted to illustrations of the work at the Finsbury Technical School. These are specially remarkable as showing the admirable methods which characterise the whole of the work there, and which, we venture to think, deserve careful study. A room is devoted to the mechanical laboratory and appliances, and a large amount of space to the department of electrical engineering, while a special feature in the display is the printed explanatory paper of notes attached to each piece of apparatus. Another good example of English technical education is the collection of drawings and models relating to coach and carriage building, to which three organisations contribute, illustrating the alterations that occur in the conditions of locomotion. There is a very good collection of excellent specimens of school work done in the Allan Glen's Institution of Glasgow, in which the object of a two years' technical course is to prepare boys to learn trades whose mastery implies a considerable amount of scientific knowledge. University College, Nottingham, exhibits some work done in the recently established technical school attached to it, and the Engineering Department of University College, London, illustrates its work mainly by photographs and plans. The nearest approach to the handicraft school teaching as practised on the Continent, is to be found in the admirable technical work of the Central Higher School of the Sheffield School Board, in which an attempt is made to provide the proper connection between the theoretical instruction in the class-room and the practical instruction in the workshop. The Manchester Technical School, the Oldham School of Science and Art, the Clerkenwell Technical Drawing School, and the School of Art Wood carving all show praiseworthy results of technical training. Attention may here be called too to the admirable specimens of work done in the four trades-departments of the National Industrial Home for Crippled Boys; the pupils vary in age from twelve to eighteen, and having chosen a trade on entering the school, follow it for three years.

Among the results of the work of individual exhibitors, the exhibit of Mr. Robins calls for special notice, consisting as it does of a series of drawings illustrative of the general arrangements and fittings required for applied science educational buildings; these are so placed that comparisons are readily made between the arrangements adopted in various noted colleges, &c. Mr. Millis shows some excellent results of instruction in trades classes, specially models in wood and metal-plate work. Mr. James Rigg exhibits more than a hundred mechanical models specially arranged for instruction in four or five of the subjects in which the Science and Art Department examines pupils, and a smaller collection of the same kind is shown by Messrs. Gilkes and Co. Lathes of different patterns, and other mechanical tools and apparatus, are exhibited by Messrs. Holtzapffel and Co., Messrs. Melhuish and Sons, Mr. Syer, Mr. Evans, and others.

In neither of these articles has any reference been made to the appliances for elementary art instruction, nor to the special methods and apparatus used in educating the blind, and the deaf and dumb, all of which, however, are very fully illustrated. The seven classes of exhibits which come under "Group IV.—The School" (to quote the official phraseology) are also unnoticed. These comprise such important subjects as everything relating to the structural arrangements of school buildings, school kitchens, sanatoria, and infirmaries, and lastly, though by no means least in importance, the gymnastic and other apparatus for physical training in schools. Enough however has, we hope, been said to give some idea of the vast scope of this exhibition of educational appliances, and to justify the assertion made at the beginning of the first article, that probably no such extensive and valuable a collection of school appliances, methods, and results has ever been brought together before. Such an opportunity for study is not likely to occur again for some years, and we conclude by reiterating an earnest hope that it will not be lost by those most vitally interested in it.

WM. LANT CARPENTER

CHEMICAL RESEARCH IN ENGLAND

THE address of Dr. Perkin, F.R.S., to the Chemical Society at its anniversary meeting contains some sadly true statements respecting the state or rather the absolute want of state of research in chemical science in this country. After drawing attention to some interesting points in the work done during the past year, Dr. Perkin goes on in the first place to refer to the very small number of original papers contributed to the Society during the past year (a point to which attention was called in these columns a few months ago), and then compares foreign sources of research work and the probable causes of this disparity. But this portion of the address will speak better for itself than in a mere abstract, and the facts therein stated demand the most serious attention of the authorities at our seats of learning.

Last year, Dr. Perkin went on to say, my predecessor, in his address, referred to the increasing number of chemical laboratories in the United Kingdom and the greater facilities which are now afforded for the prosecution of research. After considering the number of papers which have been read before this Society during the past few years, it appeared to me that it might be useful to make some remarks as to the influence these greater facilities have had on the development of chemical science.

The first thing that attracts attention is the startling and anomalous fact that the number of papers read before the Society (and I think this may be taken as a good criterion, especially as but few have been brought before the Royal Society) is declining year by year. The largest number we ever had was in the session 1880–81, when there were 113 communications brought before us; but in 1881–82 they declined to 87, in 1882–83 to 70, and this last session to the lamentably low number of 67, or about the number we had nine years ago. And this, not only with increased laboratory accommodation, but also with the assistance offered to investigators by our Research Fund and the Government Grant. This state of things causes us to look around and see where research *is* and where it *is not* being carried on in the United Kingdom.

If we look to the laboratories of our Universities, from many of these we never hear of a research emanating, and from the rest, taken as a whole, we get but driblets at intervals. How different from the German Universities, from which there is such an incessant flow of work!

If we turn to the other laboratories connected with our colleges, hospitals, &c., with how few exceptions do we find any appreciable amount of work being carried on for the extension of the boundaries of our science; in fact, speaking in a general way, the work of our laboratories consists mainly in the students carrying out the ordinary course of qualitative and quantitative analysis, and attending one or two courses of lectures.

It is scarcely necessary to say that this is not sufficient, however well taught, to make a student a chemist; it is but a preliminary part of the training, which, being carried on as it usually is, by tables, and carefully laid down directions, gives but little scope for independent thought and action. The subsequent prosecution of scientific research, under proper supervision, however, is quite another thing, and calls out all the faculties of the student, requiring, as it does, independent thought and independent methods of working, and, moreover, gives him an insight and vivid interest in his science that nothing else will do. The preparation of chemical products, before the commencement of research, is no doubt also a very useful training if sufficiently diversified; but research is the most important of all.

The degree of Doctor of Philosophy has undoubtedly done a good deal to further chemistry in Germany, necessitating, as it does, the prosecution of original work, and now that degrees are so much thought of in this country (though why a chemist with one of our ordinary University degrees should be preferred to one who has fully given his mind to his science, and therefore has not got such a degree, it is difficult to understand), it is believed that if something analogous to the Ph.D. could be inaugurated in this country, it would help to further chemical science here also. A step in this direction has been taken at the Owens College, Manchester, but hitherto the degree has not found favour with students. It is not surprising, however, while there are so many different degrees not requiring original work as a *sine quâ non*, that such a degree should not be sought after. This difficulty, however, might be overcome by modifying the requirements for the present degrees, and requiring that original research should be substituted for book knowledge. At the London University original work is recognised, but not required.

The past neglect of research will, it is to be feared, have a more lasting influence on the progress of chemistry in this country than may appear at first sight, and in this way. Those who have been students in laboratories where the importance of